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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

APPLICANT: ENTWISTLE, PAUL  
Application No.: 09/578,167  
Filing Date: 05/24/00  
For: DATA TRANSPORT STREAMS  
PROCESSING  
Art Unit: UNKNOWN



TC 2100 MAIL ROOM

AUG 28 2000

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Respectfully Submitted

HEAD, JOHNSON & KACHIGIAN

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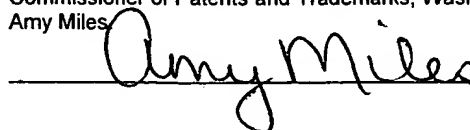
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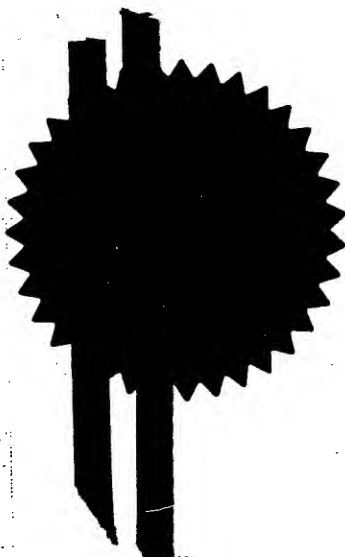
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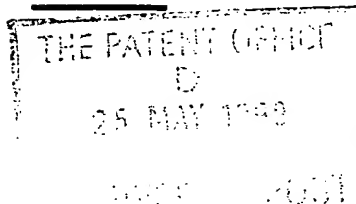
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F01/7700 0.00 - 9911989.3

The Patent Office

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1. Your reference

GW-G28485

2. Patent application number

*(The Patent Office will fill in this part)*3. Full name, address and postcode of the or of each applicant *(underline all surnames)***Pace Micro Technology Plc**Victoria Road  
Saltaire  
Shipley  
BD18 3LFPatents ADP number *(if you know it)*

If the applicant is a corporate body, give the country/state of its incorporation

U.K.

07588569001

4. Title of the invention

Data Transport Streams Processing

5. Name of your agent *(if you have one)*

Bailey Walsh &amp; Co.

"Address for service" in the United Kingdom to which all correspondence should be sent *(including the postcode)*5, York Place  
Leeds  
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Claim(s)

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## Data Transport Streams Processing

The invention which is the subject of this application relates to apparatus for receiving a stream of data, typically digital data, and which can be required to receive more than one stream of data without causing failure of the processing system.

Conventionally, in apparatus such as receivers for domestic use for the reception of broadcast video, audio and/or auxiliary data and for the processing of the data for the generation of television programmes on a display apparatus connected thereto, the receiver receives and processes a single transport stream of digital data. This single stream of data is transmitted from a remote location in a number of alternative ways but in each case the receiver is typically only able to receive and process a single stream of data. The stream of data may include data relating to audio and video, different programme channels and so on and the data is identified in packets or groups and split by the receiver into the packets which are then processed in the appropriate manner.

In the relatively new and expanding area of broadcast digital data processing, there is a demand for the receiver to be able to receive and process more than one transport stream of data at the same time. In the present receivers as the integrated circuits used can only receive one input this is not possible and therefore there is a need for a solution to be found. It is known for relatively expensive and complex apparatus to be able to receive and process multiple transport streams of data, but this form of apparatus cannot be economically or quickly incorporated in receivers for use in large volumes for domestic use.

The aim of the present invention is to provide a receiver for transport streams of data which can be used and sold commercially

on a large scale and which receiver has the capability to receive and process more than one transport stream of data and allow the generation of video and audio display or displays and/or perform other functions as selected by the user of the receiver.

In a first aspect of the invention there is provided a receiver apparatus for receiving and processing data received in a number of transport streams said receiver incorporating means for receiving said transport streams, and processing means which allow the streams of data to be demultiplexed, remapped and then multiplexed into a single transport stream of data for subsequent processing in the receiver.

In one embodiment the transport streams of data are received from any or any combination of a remote broadcast location or locations, and/or from data storage means connected to or incorporated in the receiver and/or other sources connected to or incorporated in the receiver.

Typically the single transport stream which is generated by multiplexing includes selected packets of data from the streams of data received. The packets of data may be selected automatically as they represent data which is required for the system to operate correctly, and/or in response to user selections such as to watch a particular channel, a pre recorded program and/or to record programmes and it should be appreciated that another feature of the invention is the ability to split the data from the transport streams and to select to multiplex data into a single stream, store/record data and/or discard data in accordance with operating parameters at any instant.

The arrangement of the current invention allows data which has been received from a number of transport streams to be processed

using integrated circuits which can accept one data input as the integrated circuits are presented with data in a single transport stream. These integrated circuits for the further processing of the data can be the same as those currently included in the receiver with no, or limited, alteration to perform processing of multiple transport streams of data which, until now, has not been possible.

Typically, the single transport data stream which is generated is presented to a single input component or components in the receiver for further processing and to allow the data to be used to perform the designated function. The designated function can be any or any combination of the generation of video displays, audio displays, recording of programmes, playback of recorded programmes, generation of electronic programme guides, linking with internet services, e-mail, interaction with a PC , video and so on.

In a further aspect of the invention there is provided a method for the generation of a single stream of data for subsequent processing, from multiple transport streams of data, said method comprising the steps of receiving a number of transport streams of data, demultiplexing the data, remapping the data and selecting the packets of data in accordance with user and/or receiver selection criteria and multiplexing the said selected packets of data into a single stream of data.

Typically at least one of the received transport streams of data is broadcast data received from a remote location and containing any or any combination of audio, video and auxiliary services data.

The demultiplexing of the received data from each transport stream is performed in accordance with information transmitted along with the data and identified by the receiver which in turn identifies the

packets of data. The remapping of the data packets' identifier takes place under control of the receiver so as to allow the required data to be multiplexed into a single stream and avoid identifier clashes between packets of data from different transport streams. The locally controlled remapping of the packet identifiers can allow the origin of the data to be subsequently identified in subsequent processing of the same.

As the receiver controls the remapping of the data, the current apparatus and method is distinguished over the prior art and the remapped packet identifiers which are generated typically do not relate to the data itself, it is provided to allow the data to be placed into a single transport stream to be presented for further processing.

A specific embodiment of the invention is now described with reference to the accompanying diagram and example as follows.

There is provided a receiver, indicated by the general numeral 2 in the accompanying diagram, which is provided to receive broadcast transport streams of data from a first tuner 4 and a second tuner 6, both of which receive broadcast data transport streams from remote sources. A Hard Disk Drive 8 from which the receiver accepts AV data is also provided and data from this treated as data from a further transport stream as is described. When the first and second transport streams of data are received demultiplexers 10,12 are utilised for the respective streams to split, route and possibly process the packets of data from the data streams. This allows the subsequent identification and processing, by the receiver, of the PSI and SI information from the first and second transport streams.

Referring once more to the diagram and the example. The Hard Disk Drive 8 is configured to record two programmes, one from



each of the tuners 4,6 and is also a source of data for a pre-recorded programme which is to be decoded and viewed at that time. In addition auxiliary information from the first and second transport streams is required to be sent for further processing in the receiver.

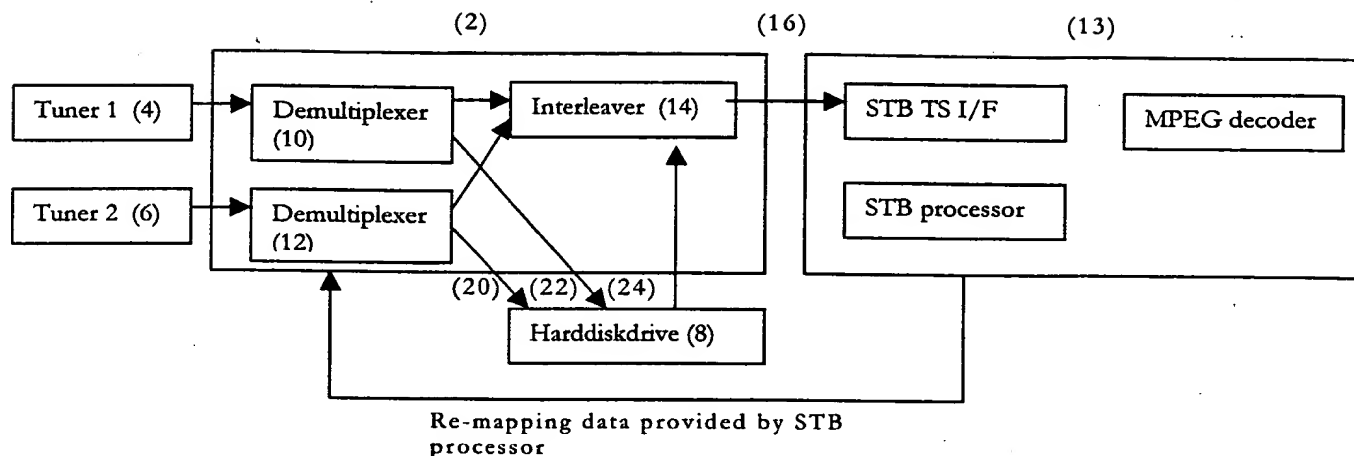
Each data stream includes groups or packets of data which are provided for a number of different purposes such as audio, visual and/or auxiliary functions. The packets of data in the transport streams are identified by Packet identifiers (PID's) which, in accordance with the invention, may need to be remapped which effectively re-identifies the same with respect to data from other transport streams so as to avoid unintentional merging of packets of data. With the transport data streams demultiplexed as described, the multiplexer/interleaver 14 is instructed to perform remapping, of the selected packet identifiers of those data packets routed to it. With selected packets remapped as required, to perform selected functions, the selected packets of data are multiplexed into a single transport stream of data 16 which can then be processed by the single input integrated circuits 13 in the processing facility within the receiver which are capable of accepting and receiving a single transport stream of data but not multiple streams of data.

The receiver further configures the demultiplexers to identify and select the packets of data relating to the auxiliary information, for example those data packets corresponding to descrambling control and management, and routes these to the interleaver 14 which inserts these packets of data into the multiplexed single transport data stream 16 and the PID's for the packets of data are changed on the basis of the receiver processing knowledge. The receiver can then manage the recording and decryption of the two programmes as it is capable of monitoring the PSI/SI and auxiliary data of the two programmes. It will be noted that the demultiplexed data for the programmes to be recorded from the demultiplexers is sent to

the Hard Disk Drive directly via paths, 20,22. In addition AV data 24 from the Hard Disk Drive is also inserted into the single data stream 16 and, as the receiver is controlling the processing of the data there is no need to construct a PSI table to identify the AV packet identifiers, as the PID's are already known and changed as required by the receiver.

The data provided below indicates the data streams which are generated in response to the example described above wherein the programmes to be recorded from the two tuners are represented by the codes X1A1,X2V1 and Y4A2,Y5V2 respectively and are sent to the Hard Disk Drive to be stored. Auxiliary data represented by the codes X3PS and Y3PS is sent from the tuners to be multiplexed with data for the recorded programme to be viewed which originates from the Hard disk Drive and is represented by the codes Z1A1 Z2V1. It will be noted how, when the packets of data are multiplexed the PID's are changed to S3PS, S6PS, S7A1, S8V1 respectively.

Thus the current invention allows existing processing capabilities which can only receive one transport stream of data to be utilised in apparatus which is adapted in accordance with the invention to receive data from more than one transport stream.



#### EXAMPLE DATA STREAMS

```

Tuner 1
Demux to Interleaver : X1A1 X2V1 X3PS X4A2 X5V2 X3PS X6A3 X7V3 X3PS X1A1 X2V1 X3PS .....
Demux to HDD         : X1A1 X2V1 X3PS X3PS X3PS X1A1 X2V1 X3PS .....

Tuner 2
Demux to Interleaver : Y1A1 Y2V1 Y3PS Y4A2 Y5V2 Y3PS Y6A3 Y7V3 Y3PS Y1A1 Y2V1 Y3PS .....
Demux to HDD         : Y3PS Y3PS Y3PS Y4A2 Y5V2 Y3PS Y3PS Y3PS Y3PS .....

HDD to interleaver   : Z1A1 Z2V1 Z1A1 Z2V1 Z1A1 Z2V1 .....

Interleaver output   : S7A1 S8V1 S3PS S6PS S7A1 S8V1 S3PS S6PS S7A1 S8V1 S3PS S6PS .....

```

Re-mapping table for use by the interleaver (provided by STB processor):

```

INPUT TAG : X1 X2 X3 Y4 Y5 Y3 Z1 Z2 .....
OUTPUT TAG : S1 S2 S3 S4 S5 S6 S7 S8 .....

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Notice that even if the same codes are in the source streams, since the source is known a different mapping can be assigned.

#### Nomenclature :

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X1,X2 ... Packet identification codes for packets sourced from Tuner 1
Y1,Y2 ... Packet identification codes for packets sourced from Tuner 2
Z1,Z2 ... Packet identification codes for packets sourced from the hard disk drive

A1,A2 ... Audio packet belonging to programme 1,2 ... for the specific tuner
V1,V2 ... Video packet belonging to programme 1,2 ... for the specific tuner
PS ..... System information packet (eg. SI, PSI, ECM, EMM etc.)

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NB: There will be many system information packets each with different packet identification codes and clashing between the two sources, all requiring unique re-mapping. Unlike professional remultiplexing equipment, it is not necessary to adjust the contents of the data packets to reflect the remapping of the packet identifiers. Since the remapping is performed with the knowledge and under control of the STB processor, all necessary information is available to the STB to correctly interpret the packet identifications referred to in the packet data, by reference to the remapping table. This only needs to be done as and when it needs to and not for the entire data stream. It therefor represents a simpler and more cost-effective solution.

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